

LUCERNE LECTURE

Quantum Theory of the Human Person

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This talk is about you as a human person.

It is about science's conception of you as a human person.

It is about what makes you different from a machine.

It is about your *mind*, and how your mind influences your bodily actions.

It is about:

The causal connection between your mind and your brain.

When I tell someone that I study the connection between

The Mind and The Brain, the immediate reply is often:

“What's the difference? I thought they were the same thing!”

Your *mind* is your stream of consciousness. It consists of your thoughts, ideas, and feelings, and is described in *psychological* or *mental* terms.

Your *brain* is an organ in your body consisting of nerve cells and other tissues, and is described in *physical* terms---basically in terms of *properties assigned to tiny space-time regions*.

Minds and brains are obviously related. Your conscious intention can cause your arm to rise. What happens is this: Your thought causes nerve impulses to emanate from your brain, and these cause your muscles to contract, and those contractions cause your arm to rise.

But how, according to the basic principles of science, does your conscious thought initiate this chain of bodily events? How does the mental event cause the physical events?

To get the fundamental answer of science one might turn to *classical physics*. This is a theory of nature that originated with the work of Isaac Newton in the seventeenth and was advanced by the contributions of James Clerk Maxwell and Albert Einstein.

Newton based his theory on the work of Johannes Kepler, who found that the planets appeared to move in accordance with a simple mathematical law, in ways determined wholly by their spatial relationships to other objects. Their motions were apparently *independent of our human observations of them*. Newton assumed that all physical objects were made of tiny miniaturized versions of the planets, which, like the planets, moved in accordance with simple mathematical laws, independently of whether we observed them or not.

According to classical physics, the physical world is built out of tiny bits of matter/energy, and the motion of each tiny part is completely determined by its contact interactions with neighboring parts. These interactions are such that the state of the physical world at any time is completely determined by the state at any earlier time. Consequently, according to classical theory, the complete history of the physical world *for all time* is mechanically fixed by contact interactions between its tiny component parts---along with the initial condition of the primordial universe.

But this means that, according to classical physics, *you are a mechanical automaton*: your every physical action was pre-determined before you were born solely by mechanical interactions between tiny mindless entities.

That makes your mental side *causally redundant*: everything you do is completely determined by mechanical conditions alone, without reference to your thoughts, ideas, feelings, or intentions. Your intuitive feeling that your mental intentions make a difference in what you do would be an illusion.

Many scientists, philosophers, writers, intellectuals, teachers, and policy makers actually claim to believe this mechanical conception of human beings, and base policies upon it. They believe that this is what science says, and hence that this is what we must believe.

But this is *not what science says!* It is what *classical physics* says!

Classical physics is merely *an approximation* to a more accurate theory---called quantum mechanics---and quantum mechanics says just the opposite. Quantum mechanics incorporates the causal effects of mental intentions upon physical systems, and explains how your mental effort causes your arm to rise. Quantum theory converts science's picture of you from that of a mechanical automaton to that of a mindful human person. The theory shows explicitly how the approximation that gives classical physics also completely eliminates all effects of your conscious thoughts upon your bodily actions.

Quantum mechanics arose during the twentieth century. Scientists discovered, empirically, that the principles of classical physics were not correct. Moreover, they were wrong in ways that no minor tinkering could ever fix. The *basic principles* of classical physics were thus replaced by *new basic principles*, and these new basic principles appear to work perfectly.

The most profound revision of the basic principles was to bring the consciousness of human beings into the basic structure of the theory.

Indeed, the whole *conception of what science is* was turned inside out. The core idea of classical physics was to describe the "world out there," with no reference to "our thoughts in here." But the core idea of quantum mechanics is to describe *our activities as knowledge-seeking human agents*, and the knowledge that we thereby acquire. Thus quantum theory involves, basically, what is "in here," not just what is "out there."

This original formulation of quantum theory is called

The Copenhagen Interpretation

because it was created mainly at the Institute in Copenhagen run by Niels Bohr. This formulation consisted essentially of a set of practical rules for how scientists should go about their tasks of acquiring knowledge, and then using this knowledge in practical ways.

Speculations about “what the world out there was really like” were *not* encouraged.

Niels Bohr said that we must never forget that “in the great drama of life we are both actors and spectators.” The emphasis is on “actors”: in the earlier classical physics we were merely spectators.

Copenhagen quantum theory is about the relationships between human agents (called observer-participants by Wheeler) and systems that they act upon and observe. Thus that formulation separates the physical universe into two parts, which are described in two different languages. One part is the observing human agent and his measuring devices. That part is described in mental terms---in terms of instructions to colleagues about how to set up the devices, and what we then “see,” or otherwise consciously experience. The other part is *the system that the agent is acting upon*. That part is described in physical terms---in terms of numbers assigned to tiny space-time regions.

This procedure works very well in practice. However, it seems clear that the body and brain of the human agent, and his devices, are parts of the physical universe, and hence that *a realistic theory* (as contrasted to a pragmatic one) ought to describe them in physical terms.

The great mathematician and logician John von Neumann reformulated the theory in a rigorous way that places the bodies and brains of the agents, along with their measuring devices, in the physical world, while retaining the essential-to-the-theory mental properties of the agents.

This von Neumann formulation provides a natural science-based account of how your thought can cause your arm to rise. I want to give you a better idea of how this works.

Von Neumann identifies two very different processes that enter into the quantum description of nature. He calls them Process I and Process II.

Process II is the analog in quantum theory of the process that in classical physics that takes the state of a system at one time to its state at a later time. However, Process II by itself is not sufficient: it generates physical worlds that do not agree with our human experiences. For example, if only Process II were present then the state of, say, the moon, would represent a structure smeared out over large parts of the sky!

In order to tie the theory to human experience another process is needed. This process is called Process I.

Process I action is unlike anything in classical physics. But it is an essential part of quantum theory: it is needed in order to tie the physically described universe of quantum theory to human experience.

Any physical theory must, in order to be complete, specify how the elements of the theory are connected to human experience. In classical physics this connection is part of a *metaphysical* substructure: it is not part of the core dynamical description. But in quantum theory this connection to human experiences becomes part of the essential dynamical structure.

Process I represents the effect upon a physical system of an intentional action by a human agent. In its basic form this action will lead to one, or the other, of two *alternative possible feedbacks*, either “Yes” or “Not-Yes.” The “Yes” feedback is an *intention-controlled recognizable experiential feedback*, and “Not-Yes” represents the failure of the “Yes” feedback to appear.

For example, a scientist might act to place a Geiger Counter close to a radio-active source, with the intention of finding out whether “Yes,” the counter is recognized to have “fired” during a certain time interval or “No,” this specified possible experiential feedback *fails to appear*.

In von Neumann quantum theory the system being acted on is, in the final analysis, *the brain of the agent*, and it is acted upon by *the mind of the agent*.

Thus Process I represents a dynamical action of the mind of an agent upon his brain.

Here is how it works.

If the letter S represents the state of the system being acted upon by the agent then Process I can be represented by the following *diagram*:

$$S \rightarrow PSP + (I-P)S(I-P)$$

This diagram is actually the mathematical formula of quantum theory that represents this Process I action. But I shall treat it here as simply a *picture* of the Process I action:

It exhibits the key fact that this Process I action changes the state S of the system being acted upon into a *sum* of two parts.

The first part, PSP, represents the possibility in which the experiential feedback called “Yes” appears, and the second part, (I-P)S(I-P), represents the possibility that this feedback does not appear.

The symbol P is important: it represents the fact that the Process I depends on *the intention of the agent*.

Notice that Process I produces the *sum* of the two alternative possible feedbacks, not just one or the other.

Since the feedback must either be “Yes” or “Not-Yes,” one might think that Process I, which *keeps* both “Yes” and “Not Yes” (= “No”), would do nothing. But that is not correct! This point can be illustrated by another diagram:

$$S = PSP + (I-P)S(I-P) + PS(I-P) + (I-P)SP$$

This diagram represents the fact that the state

S is a sum of four parts, two of which are eliminated by Process I.

This means that:

The Process I action, without any choice between “Yes” and “Not-Yes”, already affects the state being acted upon. And this action depends upon P, which is determined by the intention of the agent.

That is the *first key point*: quantum theory has a specific dynamical process, Process I, which specifies the effect upon a physical system of an *intention-controlled act* of a human agent.

The second key point is this: The agent’s choices are “free choices”

This *freedom of the agent* to choose which, if any, action he will take is a key idea in quantum theory. In the words of Niels Bohr:

“The freedom of experimentation, presupposed in classical physics, is of course retained and corresponds to the free choice of experimental arrangement for which the mathematical structure of the quantum mechanical formalism offers appropriate latitude.”

This “freedom of choice” follows, in the Copenhagen approach, from the fact that the physical observer is not part of the physical system that is described by the quantum mathematics. He stands outside the system that is governed by the known deterministic quantum laws.

Thus this “freedom” means merely “not determined by the known physical laws!” But there could be further “psychological laws,” as yet unknown, that could supplement the known physical laws, which, by themselves, do not determine this “free choice!”

But if the agent is *free* to choose which action to take, and the *intention* of that action affects the state being acted upon, then the agent’s free mental choice of intention influences the state being acted upon, which in von Neumann quantum theory is his brain.

This is the important conclusion: Orthodox (von Neumann) quantum theory has a Process I action that, on the one hand, is needed to tie the theory to human experience, and that, on the other hand, injects an effect of the mental intention of the human agent into the state of his brain.

This dynamical structure provides the foundation for a quantum theory of the conscious human person. It is being developed, and is being applied and tested in many fields, specifically, psychology, clinical psychiatry, neuroscience, psychology of attention, evolutionary biology, the philosophy of mind, aesthetics, the philosophy of mathematics, and moral philosophy. I have time here only to state briefly an application in each of these fields.

Psychology: In my book *Mind, Matter, and Quantum Mechanics* (second edition in prep.) I called this theory the Heisenberg/James theory, and tied it to the general psychological theory of the great Harvard psychologist William James. In more recent works, I have shown how James's theory of "Volition" (i.e., Will) matches detailed features of the quantum mechanical model.

Clinical Psychiatry: The recent book *The Mind and The Brain* by the University of California Psychiatrist Jeffrey Schwartz, and Sharon Begley, describes the utility of the quantum model in a clinical treatment of OCD (Obsessive Compulsive Disorder). The quantum model provides a rational way of accounting, within a coherent scientific framework, for the efficacy of the treatment, which relies on the empirically observed neuroplastic effect of self-directed effortful mental intention to restructure the physical circuitry of the brain.

Neuroscience: The availability of a model of the brain that is both compatible with basic physics yet treats psychological realities as basic variables, rather than as complex yet-to-be-understood conglomeration of billions of brain signals, aids in the physical modeling of the strong and rapid effects of self-directed intentional action to modify brain responses to varying stimuli. (See: *The volitional influence of the mind on the brain with special reference to emotional self-regulation*, J. M. Schwartz, H. P. Stapp, and M. Beauregard.)

Psychology of Attention: The book with this title by Harold Pashler describes a large amount of data, accumulated mainly during the past thirty years, that strongly suggest the existence in brain dynamics of two very different processes, one parallel and one serial. There are many experimental details that seem to be right in line with non-trivial

predictions of the quantum model. (See: *Quantum Theory and the Role of Mind in Nature*, in Foundations of Physics, 2002)

Evolutionary Biology: Classical physical theory has difficulty accounting for the fact that our mental actions are so well coordinated with our survival needs, when there is no necessary causal connection between psychological realities and bodily activities. The causal connection specified by quantum theory appears to account in a general way for the existing mind-brain connections.

Philosophy of Mind: This branch of philosophy, influenced by behaviorism, shunned for many years the mention of consciousness. Debates still rage, but the source of the disagreements appears to be the near unanimous view of philosophers that classical physics, *which is an approximation that systematically excludes the effects of mind upon matter*, is the proper scientific basis for the study of mind.

Aesthetics: The “freedom of choice” mentioned above does not mean that the agent’s choice is influenced by nothing at all. It means only that this choice is not determined by the laws of contemporary orthodox quantum theory: there is room for further laws concerning these choices. Each choice is represented by the non-local operator P. The non-local character of P means that it can access instantly the entire brain. I believe that the criterion that controls these mental choices is that of a non-discordant harmony of the activities of the many independent brain modules, each serving some function. This would mean that an essentially *aesthetic judgment* would enter into the determination of our actions.

Philosophy of Mathematics: The view just mentioned lends weight to the view that mathematical judgments, like every conscious activity, rest ultimately in aesthetic evaluations.

Moral Philosophy: The conclusion of classical physics that “all men are mechanical automata” has had a profoundly pernicious effect upon the moral fabric of our culture. The fact that the classical-physics basis of this corrosive view is now known to be wrong, and has been replaced by a more accurate physical theory that can rationally integrate a judgmental and efficacious mind into the basic nature the human person, needs to become known to all people.

Reference: This talk is based on my forthcoming book, *The Mindful Universe*, a draft of which can be found on my website:
<http://www-physics.lbl.gov/~stapp/stappfiles.html>
